REMARKS

Claims 1-12, all the claims pending in the application, stand rejected. Applicant has placed claims 4, 5 and 8 into independent form. Claims 1-3 have been cancelled.

Claim Rejections - 35 U.S.C. § 102

Claims 1-12 are rejected under 35 U.S.C. § 102(b) as being anticipated by Kawachi et al (6,135,090). This rejection is traversed for at least the following reasons.

With respect to claims 1-3, the rejection is moot in view of the cancellation of the claims. With respect to the remaining claims, they are distinguishable from Kawachi et al for the following reasons.

The Invention

By way of example by not limitation, Applicant notes that the embodiment that explains the environment for the present invention generally concerns a fuel supply control apparatus for an internal combustion engine, as illustrated in Fig. 1, having a low pressure supply of fuel (1, 2) that feeds a plurality of fuel injectors 12, which are coupled to a common rail 13, via a high pressure pump 5. The engine is operated under the control of an ECU 20 having as inputs a crank angle sensor 18 and cam angle sensor 19, as well as pressure sensor 15. The ECU 20 controls the operation of the low pressure pump 2 and the operation of a spill valve 9 in the high pressure pump 5. The high pressure pump 5 is variably operated by a pump cam 10, which is coupled to a piston 7 that is movable within a booster chamber 8. The spill valve 9 is controlled by the ECU 20 to open and close a valve 9a that, when opened, reduces the pressure in the booster chamber 8 by coupling the chamber to a return line downstream of a pressure valve 6. When the spill valve 9a is closed, fuel at high pressure is provided via another pressure valve 6 into the rail 13.

The invention is focused on the process of deciding the opening and closing timing of the spill valve that adjusts the amount of fuel discharged from a "fuel supply section." In the exemplary embodiment, the fuel supply section is in the form of the high pressure pump 5 (page 8, lines 11-13). This is accomplished by an effective stroke changing section that adjusts an

"effective stroke (i.e., an amount of discharge)" of the pump related to the discharge stroke. The effective stroke changing section is defined to comprise an opening and closing timing decision section. In the preferred embodiment, this is an ECU 20 that controls the spill valve 9 (Page 2, lines 1-8).

Claim 4 defines the invention as having an effective stroke changing section that "operates in synchronization with said crank angle signal and said cam angle signal so as to change said effective stroke based on said cam angle signals" (as taught with respect to the first embodiment and the timing chart illustrated in Fig. 3, beginning at page 11, line 15 of the specification) and further specifies a change in the effective stroke by correcting a deviation of each pulse of the cam angle signal. The application explains at pages 16 and 17 that correction processing may include adding or subtracting an error component of the cam angle signal SGC detected when the period of the crank angle signal SGD is constant, at the time of calculating the ON duration time, TWspl of the spill valve 9.

Claim 5 also defines the invention as having an effective stroke changing section that "operates in synchronization with said crank angle signal and said cam angle signal so as to change said effective stroke based on said cam angle signals" (as taught with respect to the first embodiment and the timing chart illustrated in Fig. 3, beginning at page 11, line 15 of the specification) and further specifies that the effective stroke changing section changes the effective stroke by using the cam angle signal on the suction stroke of the fuel supply section. The advantage of this feature is explained at page 17, last paragraph, specifically the application of control without reducing fuel pressure controllability, coupled with improved accuracy.

Claim 6 depends from claim 5 and further concerns features of the second embodiment wherein a period from the input timing of the cam angle signal related to the control of the effective stroke changing section to termination timing of the second stroke of the fuel supply section is set longer than a dead time due to an operation delay of the effective stroke changing section. This feature is described with regard to Figs. 7-10, beginning at page 18 and is summarized at page 21.

Claim 7 depends from claim 5 and specifies that the period from start timing of the suction stroke of the fuel supply section to input timing of the cam angle signal related to the control of the effective stroke changing section is set longer than a run up time to control the effective stroke changing section. This feature is taught at page 19 with regard to the second embodiment.

Claim 8 is directed to features of the third embodiment, and defines the invention as having an effective stroke changing section that "operates in synchronization with said crank angle signal and said cam angle signal so as to change said effective stroke based on said cam angle signals" (as taught with respect to the first embodiment and the timing chart illustrated in Fig. 3, beginning at page 11, line 15 of the specification) and further specifies the effective stroke changing section decides control timing of the effective stroke changing section based on a cam angle indicated by a cam angle signal, and changes the effective stroke by counting the number of pulses of the crank angle signal. These features relate to counter measures taken against a periodic change in the engine rotation speed, particularly with respect to Figs. 11-13, as explained beginning at page 21 and extending to page 25.

Claim 9 depends from claim 8 and further provides that the section decides whether the effective stroke can be changed or not.

Claim 10 depends from claim 9 and specifies that the operation condition of the internal combustion engine that is used in the determination of claim 9 includes rotational speed. A consideration of rotational speed is made in embodiment 4, beginning at page 25.

Claim 11 also depends from claim 9 and specifies that the operating condition includes the control state of the valve timing control section, as explained at page 29.

Finally, the subject matter of claim 12, which depends from claim 8, specifies that the crank angle detection section has an untoothed portion corresponding to a specific crank angle position. This feature is disclosed at page 30 and provides for improved accuracy in control of the spill valve 9.

Kawachi et al

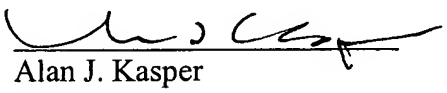
The patent to Kawachi broadly concerns a fuel injection control system, but a comparison of Fig. 1 of Kawachi et al to the limitations of claims 4-13 demonstrates that they do not appear to be taught in Kawachi. A careful review of the disclosure in Kawachi does not reveal the detail set forth in the claims and supported by the disclosure in the present application.

In this regard, Applicant notes that the Examiner has not cited a single passage from Kawachi et al in framing the rejection. For example, there is no mention of pulses of a cam angle signal as recited in claim 4. With regard to claim 6, there is no mention of a "dead time" in the entire patent nor a "run-up time" or a "count of pulses of a crank angle signal," as recited in claims 8-12. While there is a mention of a consideration of rotational speed (Fig. 6, step 1), this relates only to the injection of fuel, rather than the operation of the stroke changing section. Finally, there is no mention of any untoothed portion in a crank angle detection section, as recited in claim 12.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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